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Oil and Gas on the Brazilian Coast

Tulio Cremonini Entringer[1], Ailton da Silva Ferreira[2], Denise Cristina de Oliveira Nascimento[3], Luciano Jose de Oliveira[4], Oscar Lewandowski[5], Paulo Mauricio Tavares Siqueira[6]

[1]Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF), Campos dos Goytacazes, Rio de Janeiro, Brasil
Email: tulio_entringer@hotmail.com
[2]Universidade Federal Fluminense (UFF), Macaé, Rio de Janeiro, Brasil
Email: ailtonsilvaferreira@yahoo.com.br
[3]Universidade Federal Fluminense (UFF), Macaé, Rio de Janeiro, Brasil
Email: denise_cristin@yahoo.com.br
[4]Universidade Federal Fluminense (UFF), Macaé, Rio de Janeiro, Brasil
Email: lujoliver@yahoo.com.br
[5]Universidade Federal Fluminense (UFF), Macaé, Rio de Janeiro, Brasil
Email: oscarester@terra.com.br
[6]Universidade Federal Fluminense (UFF), Macaé, Rio de Janeiro, Brasil
Email: paulomauricio@id.uff.br

***Abstract*—** *The study of behavioral finance is characterized by analyzing the volatility of financial markets, however, in a contemporary view, one can also apply it in other fields such as commerce and factories, and its dislike to be able to invest or not its financial capital . The objective of this work is to present foreign reflections on a new branch in financial theory, Behavioral Finance, which aims to adhere the psychological and sociological aspects of the individuals in the decision making process at the time of making an investment, as well as their applications through incorporation evidence of the investor's irrationality. This new segment aims to review and improve the current economic-financial model. The association with behavioral finances provides both the understanding of the psychological process that motivates the investments, helping in the construction of a more adequate decision-making model, and in the hiring of its managers who must possess adequate technical and psychological skills in order to avoid cognitive bias as overconfidence*

***Keywords*— behavioral finance, cognitive, Rio de Janeiro.**

I. INTRODUCTION

The present work begins with a brief history of the Brazilian sea exploration related to the activities of oil extraction in the high seas in the Brazilian coast exploited in its vast majority by oil operators. From the first research for oil exploration in the high seas, through exploration in deep waters and arriving to the present day with the discovery of the zone of the Pre-Salt and the respective evolution of the logistic support to this activity.

Oil exploration is the main economic activity of the country and the predictions of the scarcity of this resource that haunts not only the Brazilian economy but the world economy has made the country search for alternative ways of exploiting this resource. The recently discovered Pre-Salt is one of these alternatives and the exploration challenges that have already begun in Brazil made it necessary to evolve both in the technological apparatus of production and support linked to it and of innovative models of administration of these resources.

Exploitation of oil in the Pre-salt zone is not an easy task, since it is located 300 km off the coast, twice as far as the Campos Basin, and these wells are drilled more than 7000 meters deep. This would require more resilient pipelines and pipelines where at that depth the aggressiveness of the environment due to pressure and corrosive agents are more severe [1] [2].

Given these scenarios, the need to overcome technological challenges and find the best way to transport not only oil and gas, but also support materials for the entire production chain and workers.

The bibliographical research aims at the theoretical basis for understanding the functioning of logistics in the Pre-salt zone. It will be searched books, articles and dissertations, selection of books, magazines, newspapers, chapter that address the main factors that influence the main characteristics of the modes of transport used and the systems of production flow. A case study was also analyzed in the Tupi Oilfield, which will serve as the main source of study of this work.

The purpose of this article is to analyze the oil logistics in the Tupi Oil Field, located in the Pre-salt zone. For this,

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the article will contemplate initial concepts about logistics and their modalities that will contribute to the study, thus permeating the main logistic challenges of the Pre-salt and the oil logistics of the Tupi field.

II. THE LOGISTICS OF PETROLEUM IN THE FIELD OF TUPI

In 2006 was discovered the largest oil field is natural gas of the country in the oilfield of Tupi in the basin of Santos. This discovery has revolutionized the national oil industry. It is the beginning of oil exploration in the pre-salt layer [3]. To reach this discovery were years of geological studies that indicated possible existence of oil in these layers, in 2004 initiated the seismic tests, data collection and exploration of exploratory wells for the purpose of estimating the amount of petroleum, analyze the viability of operating costs and production sustainability. Since the production of oil from the pre-salt would require a very high cost due to the difficulty of extracting the oil from that layer, it was necessary to know the size of these reservoirs, as can be seen in Figure 1 [3].

Fig. 1: pre-salt Explanatory figure. Source: PETRONOTÍCIAS (2013)

The scenario is quite positive, if the estimates of the first findings are confirmed, Brazil will make a leap and both in the ranking of the countries with the highest reserves, getting among the first (BERTO, MENDES and NOGUEIRA, 2012). The production from pre-salt to 2020 is estimated at 47% of the total produced by Petrobrás in Brazil [3].

It is estimated that the total area of the Tupi evaluation plan is 1,974 km2 and is located in waters of about 2,200 m of water blade, with layers of salt of 2,000 m thick [1]. The wells initially tested in Tupi indicated potential flows of 15 to 20000 barrels of oil per day and good quality of the oil with API degree from 28th to 30th considered a light oil of better quality and easier to refine than the national average In addition to natural gas [1].

2.1 MAIN LOGISTICAL CHALLENGES OF PRE-SALT

One of the major challenges awaiting Petrobras in oil exploration in the pre-salt layer is the logistics area. The distance from the coast that lies around 300 km is one of the main factors contributing to the high degree of difficulty of pre-salt logistics [1].

The constant flow of people, which today revolves around 40,000 to 60,000 people who are moved from the coast towards the platforms should double, since in 2017 Petrobras announced that it wants to build 11 more platforms only in the Holy Spirit in the area of Salt [3].

The naval sector will also need changes due to the volume of investments applied by Petrobras in the construction of new platforms and technologies that contribute to the increasing increase in production. The emergence of new naval and Offshore industries, new refineries, change in shipments and increase in autonomy, among others will be elements that would bring opportunities for bold and prepared logistics companies, those that are not Will certainly not be able to enjoy this universe.

The scenario allied with the acceleration of the area of infrastructure and pre-salt, will unleash a new cycle of mergers and acquisitions in the transport chain and storage of the country, increasing the range of services of the logistics companies that enter this market.

The individual evolution of the transport modals and the intermodal relationship should be adopted as a premise for the main logistics companies able to join airport, port and storage in solutions without enriching the tariffs.

With the installation of new platforms and the constant growth of the pre-salt infrastructure, it becomes increasingly complex and challenging to flow of production, reuse of surpluses and an effective and efficient distribution of the pipelines.

2.1.1 THE TRANSPORT MODAL OF TUPI

The Tupi oil field following the premises imposed by the operator is in the process of establishing its infrastructure. Although it is already a commercially productive field of pre-salt, Tupi is still at the beginning of phase 1a, beginning in 2013 and forecast of ending in 2017, at that stage will be used technologies already dominated or that can be quickly absorbed [3].

Following the strategy adopted by the operator, the field of Lula as was baptized, as soon as the commerciality of the field was disseminated, it is still a test area, study of behavior of new installations and behavior of production [3].

The arrival of FPSO (Floating Production Storage and Offloading) City of Paraty Day 07 June 2013 with a maximum capacity of 120,000 barrels of oil per day elevates the capacity of the field to 220 mbopd (220 a thousand barrels of oil a day) [4].

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The movement of the modal transport of the Lula field in general is of vessels that assist in the construction of the entire infrastructure of production. Construction of pipelines, drilling wells, auxiliary vessels of such installations as operators of ROVs (Remotely operated underwater vehicle), among others. There is also the presence of relief ships that drain the production of the present FPSOs Direct to the terminals on terra firma which is still the only means of draining the production of the production of the pre-salt, as can be seen in the figure 2 [4].

Fig. 2: PLSV – Vessel for launching ducts [4].

The volume of these vessels tends to increase further, the development plan of the Lula-Iracema fields includes the installation of eight FPSO Additional to 2018, year in which the total capacity of the fields will reach 1,400 mbopd-thousand barrels per day [4].

2.1.2 MODAL PIPELINE

The transport of petroleum derivatives by pipelines remains timid in the oilfield oil field, the set of flexible tubes, umbilicals and other installations, in almost its entirety are concentrated only in the movement of the oil extracted from the well towards the exploration platforms (FPSOs), passing through umbilicals and risers [5].

Based on the information disseminated by petrobras, there are several challenges in this follow-up, it will be necessary to improve the rise pipe (riser), taking into account the high pressures arising from the depth, the high corrosive power due to the high concentration of CO2, are new situations requiring pipes with new rigid materials and line-type conformations in "s" – lazy wave; It should also improve the thermal insulation of the pipes considering the depth in water slides of 2,200 m. and pipes for injection of gas at high pressures [1].

From these challenges presented it is concluded that Petrobras will have to invest in other areas besides logistics, such as engineering, in order to develop new materials capable of mitigating the effects of pressure and corrosion.

Petrobras has established long-term contracts and defined an early approach to the market as fundamental to the strategic purchasing Process. In addition, it defined basic guidelines that include the increase of local content, support of the increase in Brazilian manufacturing capacity, equipment standardization and easing of these contracts to enable the incorporation of new technologies [6].

Adaptations are already being made in parts of production lines and equipment, as well as in pipeline launch craft, with the view that the exploitation of this new oil frontier requires more resistant materials because of the worsening conditions corrosive, depending on the increase in Pressure [7].

On the other hand, the Squid-mussel pipeline put into operation since September 19, 2011 is an unprecedented milestone for Brazilian engineering: with capacity to seep up to 10 million cubic meters, 216 kilometers long, 18 inches in diameter, is the pipeline wWith greater depth and length of submarine rigid duct already installed in Brazil [3] [8].

At the level of drainage through the ducts, the Squid-mussel pipeline presents high flow Capacity. Due to its extension, it has been found that Petrobras is able to build new lines starting from the pre-salt, connecting wells and platforms until the arrival of the gas to the coast.

It is part of a water depth of 2,200 meters, where it is interconnected to the FPSO city of Angra dos Reis, in the field of Lula, until it reaches 180 meters, where it is connected to the mussel platform, owned by petrobras, situated in shallow waters in the basin of Campos , as can be seen in the Figure 3 [9].

Fig. 3: Squid-Mussel pipeline line [10].

This project will also contribute to the disposal of the natural gas of the platforms intended for the development of the first phase of the pre-salt of the Santos basin, as can be seen in Figure 4.

Fig. 4: Detailed view of the Squid-Mussel pipeline line [11].

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The Squid-Mussel pipeline has been linked to the following installations of the Petrobras system: to the mussel field to the gas treatment unit (UTGCA) Monteiro Lobato, which is located in Caraguatatuba (SP), with the objective of enabling the arrival of the gas to the Caraguatatuba-state pipeline, which connects the gas processed in that unit to the distribution mesh of natural gas to the national market [12].

2.1.3 MODAL AIR – THE LOGISTICS OF PEOPLE IN PRE-SALT

Currently in the Campos basin, Petrobras carries an impressive volume of passengers from the mainland to the platforms, about 40,000 people a month, in more than 6,000 flights [3]. This number tends to double with the development of pre-salt, which would effectively be unfeasible due to the volume of people who are transported incompatible with the quantity and current structures of the existing aerodromes.

Another challenge is the long distance of the pre-salt installations of the Brazilian coast, which is around 300 km, in some situations the triple in comparison of the distance that is the basin of Campos of the Brazilian Coast. This distance is above the limit of flight autonomy of most aircraft operating in the field basin of Campos [3]. In addition, transport operations are subject to greater climatic instability.

"The aircraft need to be large, able to face the harsh weather conditions on the high seas and have autonomy to fly for 300 kilometers and return" [13].

"The EC225 Super Puma helicopter has transport capacity for up to 19 passengers plus two riders, depending on the configuration, "as can be seen in Figure 5 [14].

Fig. 5: EC225 SUPER PUMA helicopter [15].

The large aircraft that only a few years ago had higher costs than the mid-sized, are now becoming financially Competitive. Another important advantage of large aircraft is the transport management and Aerodrome capacity, because its use provides a transport of more passengers with fewer flights and in this way fewer helicopters and vacancies are needed Parking at aerodromes, In addition to facilitating the process of air traffic management.

III. REVOLUTION IN PRE-SALT BUSINESS LOGISTICS

The final phase of consolidation of Brazilian pre-salt, phase 1b, to be initiated after 2017, will serve as a field laboratory for the development of new technologies [3].

In this period, unconventional technological innovations in High-scale will be incorporated to complete the definitive development of pre-salt production areas, focusing on cost reduction and the optimization of deposits ' recovery rates, as can be seen in Figure 6 [3].

Fig. 6: Major technological developments in evaluation [2].

It can be seen in Figure 06 the main projects of Petrobras for the technological development of the Pre-salt. Explain in this chapter how some of these projects will work when they are deployed.

One of these proposals for the development of Petrobras is the construction of floating bases midway between the coast and the productive fields of the pre-salt of the Santos basin, seen the difficulty of logistical support due to the distance already cited in this work. "it would be an outlet for the logistical problems we will face due to the distance" [16].

It can be observed that the distribution system present in the basin of Campos and also today in the basin of Santos is the direct, where the coast (airports, airfields and ports) is the central terminal and the platforms located in the fields in the high seas, the destination" [16].

Hubs are floating bases that will function as distribution centers for people and loads in the middle of the ocean. Workers will be transported in high-capacity passenger craft, between 150 and 300 people up to those bases that are installed at a point closer to the coast, from that point would set off to the platforms through flights in smaller helicopters, which run shorter distances, reflecting on time and fuel economy [17].

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In spite of the improvement of pipeline transport, a solution studied by the operator is the geological capture, transport and storage systems of carbon dioxide (co2), through the technology development program for CO2 (PRO-CO2) [3]. This project aims to study the possibility of reinjecting carbon dioxide into reservoirs with the aim of increasing the recovery of reserves; Storage of gas in saline aquifers under the seabed; Reinjection into gas reservoirs already depleted and storage in caves in the salt layer, with which emissions would be avoided in the earth's atmosphere [3]. Among other benefits this technology aims to reduce the corrosive effects in the ducts, materials and equipment by the presence of CO2.

The operator is still studying the best alternatives to enable the pre-salt logistics, because it is a complex process, it needs to carefully treat the implementation of each alternative of technological development studied.

IV. FINAL CONSIDERATIONS

The study of the business logistics carried out in this work proposed to synthesize the knowledge newly with the new experience of the exploration and production of the brazilian pre-salt.

It is observed that the operator had a history of successive hits and that the prospecting of the Brazilian sea provided a great incentive to develop new technologies, but there is still a long way to go.

The theory as to the location of the facilities addressed were addressed to reflect on the main characteristics that involve the installations of the sedimentary basins in the sea.

The analysis of the modals previously made by these authors is also crucial to verify the characteristics of each of them, as well as, the intermodal relations and in this work serves as support for the understanding of the business logistics of the pre-salt, since, the modals used in the Pre-salt business logistics have environmental influences and varied technological interventions which makes a complex subject of being studied.

The exploration and production of Brazilian oil has achieved excellent results in recent years, the discovery of the pre-salt boosted the investments in logistics and caused that not only the operator as all logistical support companies directed their resources in technology and innovation.

Although the investments are high, the results obtained with the first tests are increasingly encouraging and the effective production of pre-salt will make Brazil become not only one of the main producers of world oil, but the holder of the major logistics technologies.

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